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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	1204US
First Inventor	David Drell
Title	Videoconferencing Apparatus...
Express Mail Label N	EL666126127US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [X] Fee Transmittal Form (e.g., PTO/SB/17)
    (Submit an original and a duplicate for fee processing)
2. [ ] Applicant claims small entity status. See 37 CFR 1.27.
3. [X] Specification   [*Total Pages* 26]
    (preferred arrangement set forth below)
    - Descriptive title of the invention
    - Cross Reference to Related Applications
    - Statement Regarding Fed sponsored R & D
    - Reference to sequence listing, a table, or a computer program listing appendix
    - Background of the Invention
    - Brief Summary of the Invention
    - Brief Description of the Drawings (*if filed*)
    - Detailed Description
    - Claim(s)
    - Abstract of the Disclosure
4. [X] Drawing(s) (35 U.S.C. 113)   [*Total Sheets* 5]
5. Oath or Declaration   [*Total Pages* [ ]]
    a. [ ] Newly executed (original or copy)
    b. [ ] Copy from a prior application (37 CFR 1.63 (d))
        (for continuation/divisional with Box 17 completed)
        i. [ ] **DELETION OF INVENTOR(S)**
            Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. [ ] Application Data Sheet. See 37 CFR 1.76

ADDRESS TO: Box Patent Application
Washington, DC 20231

7. [ ] CD-ROM or CD-R in duplicate, large table or Computer Program (*Appendix*)
8. Nucleotide and/or Amino Acid Sequence Submission (*if applicable, all necessary*)
    a. [ ] Computer Readable Form (CRF)
    b. Specification Sequence Listing on:
        i. [ ] CD-ROM or CD-R (2 copies); or
        ii. [ ] paper
    c. [ ] Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. [ ] Assignment Papers (cover sheet & document(s))
10. [ ] 37 CFR 3.73(b) Statement (*when there is an assignee*)   [ ] Power of Attorney
11. [ ] English Translation Document (*if applicable*)
12. [ ] Information Disclosure Statement (IDS)/PTO-1449   [ ] Copies of IDS Citations
13. [ ] Preliminary Amendment
14. [X] Return Receipt Postcard (MPEP 503) (*Should be specifically itemized*)
15. [ ] Certified Copy of Priority Document(s) (*if foreign priority is claimed*)
16. [ ] Other: ....
    ....

17. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:*
    [ ] Continuation   [ ] Divisional   [ ] Continuation-in-part (CIP)   of prior application No.:_____/_____

    Prior application information.   Examiner_____   Group / Art Unit. _____

For CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation <u>can only</u> be relied upon when a portion has been inadvertently omitted from the submitted application parts.

18. CORRESPONDENCE ADDRESS

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Signature	*Douglas E Mackenzie*	Date	10/5/2000

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FEE TRANSMITTAL
for FY 2000

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($) 710.00

Complete if Known	
Application Number	unknown
Filing Date	10/5/2000
First Named Inventor	David Drell
Examiner Name	
Group Art Unit	
Attorney Docket No.	1204US

METHOD OF PAYMENT (check one)

1. [X] The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account Number: **06-0600**

Deposit Account Name:

[X] Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

[ ] Applicant claims small entity status. See 37 CFR 1.27

2. [X] **Payment Enclosed:**
[X] Check [ ] Credit card [ ] Money Order [ ] Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Fee ($)	Small Entity Fee Code	Fee ($)	Fee Description	Fee Paid
101	690	201	345	Utility filing fee	710.00
106	310	206	155	Design filing fee	
107	480	207	240	Plant filing fee	
108	690	208	345	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 710.00

2. EXTRA CLAIM FEES

	Extra Claims		Fee from below	Fee Paid
Total Claims	12	-20** =	X	=
Independent Claims	2	- 3** =	X	=
Multiple Dependent			=	

**or number previously paid, if greater; For Reissues, see below*

Large Entity Fee Code	Fee ($)	Small Entity Fee Code	Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	78	202	39	Independent claims in excess of 3
104	260	204	130	Multiple dependent claim, if not paid
109	78	209	39	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) ——

FEE CALCULATION (continued)

3. ADDITIONAL FEES

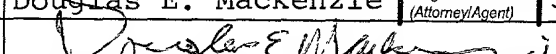| Large Entity Fee Code	Fee ($)	Small Entity Fee Code	Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	380	216	190	Extension for reply within second month	
117	870	217	435	Extension for reply within third month	
118	1,360	218	680	Extension for reply within fourth month	
128	1,850	228	925	Extension for reply within fifth month	
119	300	219	150	Notice of Appeal	
120	300	220	150	Filing a brief in support of an appeal	
121	260	221	130	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,210	241	605	Petition to revive - unintentional	
142	1,210	242	605	Utility issue fee (or reissue)	
143	430	243	215	Design issue fee	
144	580	244	290	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	690	246	345	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	690	249	345	For each additional invention to be examined (37 CFR § 1.129(b))	
179	690	279	345	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) _____

* Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) ——

SUBMITTED BY

		Complete (if applicable)	
Name (Print/Type)	Douglas E. Mackenzie	Registration No (Attorney/Agent)	38,955	Telephone	650-812-3400
Signature		Date	10/5/2000

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1 **VIDEOCONFERENCING APPARATUS HAVING INTEGRATED**

2 **MULTI-POINT CONFERENCE CAPABILITIES**

3

4 Cross Reference to Related Applications

5   The present invention claims priority from U.S.

6 Provisional Patent Application Ser. No. 60/157,711 filed on

7 October 5, 1999, the entire disclosure of which is

8 incorporated herein by reference.

9

10   BACKGROUND OF THE INVENTION

11 1.   Field of the Invention

12   The present invention relates generally to

13 conferencing systems, and more particularly to a

14 videoconferencing apparatus for use with multi-point

15 conferences.

16

17 2.   Background of the Prior Art

18   Videoconferencing systems have become an increasingly

19 popular and valuable business communications tool. These

20 systems facilitate rich and natural communication between

21 persons or groups of persons located remotely from each

22 other, and reduce the need for expensive and time-consuming

23 business travel.

1   At times, it may be desirable to conduct multi-point

2   conferences, wherein three or more parties (each party

3   consisting of an individual or group located at a

4   particular conference endpoint) participate in the

5   conference. Multi-point conferences are particularly

6   useful in situations where several interested parties need

7   to participate in the resolution of an issue, or where

8   information is to be disseminated on an enterprise-wide

9   level. However, commercially available video conferencing

10   systems are generally capable of communicating with only

11   one other conference endpoint at a time. To conduct multi-

12   point conferences, the conference endpoints are

13   conventionally interconnected through an external piece of

14   equipment called a multi-point control unit (MCU). The MCU

15   is provided with multiple ports for receiving signals

16   representative of audio and video information generated at

17   each of the conference endpoints. The received signals are

18   mixed and/or switched as appropriate, and the

19   mixed/switched signals are subsequently transmitted to each

20   of the conference endpoints.

21   A significant disadvantage associated with the use of

22   MCUs is their expense. An enterprise wishing to conduct

23   multi-point conferences must either purchase a MCU, which

24   may cost upwards of $50,000, or contract for "video bridge"

1 services through a telephone company, wherein an MCU

2 located at the telephone company's facilities is rented on

3 a fee per unit of usage basis. In either case, the high

4 cost of purchasing or renting an MCU may dissuade a company

5 from conducting multi-point conferences, even when it would

6 be useful to do so.

7 Conventional MCUs further require a dedicated Inverse

8 Multiplexer (IMUX) for each endpoint of a multi-point

9 conference. These dedicated IMUXs are hardware devices

10 which must be purchased and installed at additional cost to

11 achieve increased endpoint capability.

12 Finally, conventional MCUs include hard-wired

13 processing units each having a dedicated set of channels

14 associated therewith. Thus, unused channels associated

15 with a processing unit are unavailable for allocation to

16 additional endpoints.

17 What is therefore needed in the art is a relatively

18 low-cost videoconferencing apparatus which can dynamically

19 allocate unused channels on an as needed basis.

1   <u>SUMMARY OF THE INVENTION</u>

2   The present invention is directed to a multi-point

3   (MP) conferencing application having dynamically allocable

4   software-based IMUX functions. The IMUX functions are

5   implemented in a software-based circuit switch operable to

6   aggregate a plurality of processing trains to a wideband

7   serial data stream. The IMUX functions are created on an

8   as needed basis for each endpoint in a multi-point

9   conference.

10   The MP conferencing application is coupled to a

11   conventional network interface including a time division

12   multiplexer. The time division multiplexer is in turn

13   coupled to a plurality of communication ports, which may

14   typically include ISDN ports, enabling an apparatus

15   including the MP conferencing application to be coupled to

16   two or more remote conference endpoints through a switched

17   network.

18   The (MP) conferencing application is operable to

19   process the plural signal streams received through the

20   communication ports. Generally, the MP conferencing

21   application generates separate processing trains for signal

22   streams from/to each of the remote conference endpoints.

23   The processing trains each comprise a communication process

24   and a set of codecs. In the receive mode, an IMUX function

4

1 combines signal streams (representative of a single

2 conference endpoint) distributed over two or more channels

3 into a single, relatively high bandwidth channel. The

4 communication process, which may for example comprise an

5 H.320 process (ISDN-based) or H.323 (packet-based) process,

6 separates the signal stream into audio and video signals,

7 and performs certain processing operations (such as delay

8 compensation) associated therewith. The audio and video

9 signals are thereafter respectively delivered to audio and

10 video codecs for decoding.

11 The decoded audio and video streams output by each of

12 the processing trains, together with the locally generated

13 audio and video signals, are combined at an audio mixer and

14 a video switching/continuous presence module. The video

15 module may be configured to selectively generate as output

16 video data representative of a composite or continuous

17 presence image, wherein video information (e.g., images of

18 the conference participants) corresponding to each of the

19 conference endpoints is displayed in different sectors of

20 the screen. The combined audio and video data streams are

21 conveyed as input to each processing train for encoding and

22 transmission to the corresponding conference endpoints. In

23 the send mode, the audio and video signals are encoded by

24 the audio/video codecs and multiplexed into a single data

1   stream by the communication process. The combined

2   audio/video data stream is then conveyed to the IMUX

3   function, which distributes the combined audio/video data

4   stream over the channels associated with the selected

5   remote conference endpoint.

BRIEF DESCRIPTION OF THE FIGURES

1

2   FIG. 1 depicts a near videoconferencing endpoint

3 interconnected with two remote videoconferencing endpoints,

4 the near videoconferencing endpoint having integrated

5 multi-point conferencing capabilities;

6   FIG. 2 is a block diagram of the near conferencing

7 endpoint;

8   FIG. 3 is a block diagram of a multi-point

9 conferencing application of FIG. 2;

10   FIG. 4 is a block diagram of an exemplary signal

11 processing train of FIG. 3; and

12   FIG. 5 is a block diagram of an exemplary network

13 interface.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

1

2 FIG. 1 depicts an exemplary operating environment of

3 the multi-point (MP) conferencing application of the

4 present invention. A near conference endpoint 100,

5 embodying the MP conferencing application, is coupled to

6 remote conference endpoints 102 and 104 via a network 106.

7 Remote conference endpoints 102 and 104 may comprise, for

8 example, conventional videoconferencing devices equipped to

9 transmit and receive both video (image) data and audio

10 (speech) data. Alternatively, one or more of remote

11 conference endpoints 102 and 104 may comprise conventional

12 audio conferencing devices limited to reception and

13 transmission of audio data. It should be appreciated that

14 while only two remote conference endpoints are depicted in

15 FIG.1 for the purpose of clarity, a greater number of

16 remote conference endpoints may be accommodated by near

17 conference endpoint 100.

18 Network 106 may be of any type suitable for the

19 transmission of audio and video data between and among near

20 conference endpoint 100 and remote conference endpoints 102

21 and 104. Typically, network 106 will comprise the public

22 switched telephone network (PSTN) or comparable circuit

23 switched network to which each of the conference endpoints

24 is connected by one or more ISDN lines. A multi-point

1 conference is initiated by establishing a connection

2 between near conference endpoint 100 and remote conference

3 endpoint 102, and between near conference endpoint 100 and

4 remote conference endpoint 104. Establishment of the

5 connections may be effected through a dial-up procedure, or

6 through use of a dedicated line.

7 Alternatively, network 106 may comprise a packet

8 switched network, such as the Internet. Although a single

9 network 106 is shown, the invention contemplates the use of

10 two or more networks (for example, the PSTN and the

11 Internet) to connect conference endpoints utilizing

12 different communication protocols.

13 Reference is now directed to FIG. 2, which depicts in

14 block form various components of near conference endpoint

15 100. A conventional video camera 202 and microphone 204

16 are operative to generate video and audio signals

17 representative of the images and speech of the near

18 conference participant (the person or persons co-located

19 with near videoconference endpoint 100). A video monitor

20 208 and loudspeaker 210 present images and speech of the

21 remote conference participants combined with locally

22 generated images and speech. An audio I/O interface 212,

23 configured to perform A/D and D/A conversion and related

24 processing of audio signals, couples microphone 204 and

1 loudspeaker 210 to CPU 220 and memory 222 through bus 226.

2 Similarly, video camera 202 and monitor 208 are coupled to

3 console electronics 213 through video I/O interface 214.

4   Console electronics 213 additionally include a central

5 processing unit (CPU) 220 for executing program

6 instructions, a memory 222 for storing applications, data,

7 and other information, and a network interface 224 for

8 connecting near conference endpoint 100 to network 106.

9 Memory 222 may variously comprise one or a combination of

10 volatile or non-volatile memories, such as random access

11 memory (RAM), read-only memory (ROM), programmable ROM

12 (PROM), or non-volatile storage media such as hard disks or

13 CD-ROMs. At least one bus 226 interconnects the components

14 of console electronics 213.

15   Network interface 224 is provided with a plurality of

16 ports for physically coupling near conference endpoint 100

17 to a corresponding plurality of ISDN lines 240-246 or

18 similar transmission media. The number of ports will be

19 determined by the types of connections to network 106, the

20 maximum number of remote conference endpoints which may be

21 accommodated by videoconference endpoint 100, and the

22 required or desired bandwidth per endpoint connection.

23 Depending on bandwidth requirements, data communicated

24 between near conference endpoint 100 and a remote

1 conference endpoint may be carried on a single ISDN line,

2 or may be distributed (for higher bandwidth connections)

3 among a plurality of ISDN lines.

4 Stored within memory 222 are an operating system 230,

5 a call manager application 232, and the MP conferencing

6 application 234. Operating system 230 controls the

7 allocation and usage of hardware resources, such as CPU 220

8 and memory 222. Call manager application 232 controls the

9 establishment and termination of connections between near

10 conferencing endpoint 100 and remote conference endpoints

11 102 and 104, and may also furnish information

12 characterizing the nature of individual connections to MP

13 conferencing application 234.

14 As will be described in further detail below, MP

15 conferencing application 234 is configured to instantiate a

16 processing train for each remote conference endpoint 102

17 and 104 to which near conference endpoint 100 is connected.

18 The processing trains process audio and video data streams

19 received from remote conferencing endpoints 102 and 104.

20 The processed audio and video data streams are combined

21 with each other and with locally generated audio and video

22 streams, and the combined audio and video streams are

23 thereafter distributed to remote conferencing endpoints 102

24 and 104.

1   FIG. 3 is a block diagram showing the various

2   components of an embodiment of MP conferencing application

3   234 and the flow of data between and among the various

4   components. MP conferencing application 234 includes a

5   circuit switch 350, a plurality of processing trains 302

6   and 304, a video switching/continuous presence module 306,

7   and an audio mixing module 308. The circuit switch 350

8   dynamically instantiates a number of high bandwidth

9   processing trains equal to the number of remote conference

10   endpoints to which near conference endpoint 100 is

11   connected and preferably includes an dynamically created

12   IMUX allocated to each remote conference endpoint. Each

13   IMUX preferably utilizes a bonding protocol. In the

14   example depicted in the figures, the circuit switch 350

15   dynamically allocates two IMUXs and generates two

16   processing trains 302 and 304 respectively corresponding to

17   remote conference endpoints 102 and 104.

18   Processing trains 302 and 304 preferably comprise

19   software routines which process received and transmitted

20   audio and video signals in accordance with predetermined

21   algorithms. In the receive mode, processing train 302 is

22   instantiated by circuit switch 350 to include signals

23   representative of audio and video data transmitted by

24   remote conference endpoint 102. Illustratively, remote

12

1 conference endpoint 102 may transmit signals on ISDN lines,

2 each ISDN line comprising two distinct 64 Kb/sec bi-

3 directional channels ("Bearer channels"). Those skilled in

4 the art will recognize that a smaller or greater number of

5 ISDN lines may be utilized for communication with remote

6 conference endpoint 102. As will be described in

7 connection with FIG. 4, processing train 302 is operative

8 to extract and decode audio and video data from signals

9 received from remote conference endpoint 102. Decoded

10 audio data is conveyed to audio mixing module 308 over

11 audio data path 352, and decoded video data is conveyed to

12 video switching/continuous presence module 306 over video

13 data path 354.

14 Processing train 304 similarly receives audio and

15 video data transmitted by remote conference endpoint 104.

16 Processing train 304 extracts and decodes the audio and

17 video data and subsequently passes the decoded audio and

18 video data to audio mixing module 308 and video

19 switching/continuous presence module 306 over audio and

20 video data paths 370 and 372.

21 Audio mixing module 308 is configured to combine audio

22 data received from remote conference endpoints 102 and 104

23 with locally generated audio data (received from audio I/O

24 interface 212 via audio data path 374, and typically being

13

1 representative of the speech of the near conference

2 participant(s)). The term "combine" is used in its

3 broadest and most general sense and is intended to cover

4 any operation wherein audio mixing module 308 generates an

5 output audio data stream (or plurality of output audio data

6 streams) based on information contained in the remotely and

7 locally generated audio data input streams. For example,

8 audio mixing module 308 may simply mix the received audio

9 input data streams, or it may be configured as an audio

10 switch wherein it selects one of the received audio input

11 data streams for output in accordance with predetermined

12 criteria. The output audio data stream is directed to

13 processing trains 302 and 304 and audio I/O interface 212

14 along output audio paths 376, 378 and 380.

15   Video switching/continuous presence module 306

16 combines video data received from remote conference

17 endpoints 102 and 104 with locally generated video data

18 (received from video I/O interface 214 via video data path

19 382, and being typically representative of images of the

20 near conference participants). Again, the term "combine"

21 is used in its broadest and most general sense. In one

22 mode of operation, video switching/continuous presence

23 module 306 may select one of the video data input streams

24 for output based on predetermined criteria (for example, it

1   may select for output the video data stream corresponding

2   to the conference endpoint of the currently speaking

3   participants. In a second mode of operation (referred to

4   as the "continuous presence mode"), video

5   switching/continuous presence module 306 may construct a

6   composite image wherein images corresponding to conference

7   endpoints are displayed in different sectors of the

8   composite image. The video data stream output (or

9   plurality of outputs) from video switching continuous

10 presence module 306 is thereafter distributed to processing

11 trains 302 and 304 and video I/O interface 214 via video

12 data paths 390, 392 and 394.

13   In the transmission mode, processing train 302 is

14 configured to receive the audio and video data streams

15 output by audio mixing module 308 and video

16 switching/continuous presence module 306. The received

17 data streams are then encoded and combined to form a mixed

18 encoded audio/video data stream, and the encoded

19 audio/video data stream is transmitted to the circuit

20 switch 350 via data path 344. Similarly, processing train

21 304 receives the audio and video streams output by audio

22 mixing module 308 and video switching/continuous presence

23 module 306, encodes and combines the audio and video data

24 streams, and transmits the encoded audio/video data stream

1   to the circuit switch 350 via data path 346. For each

2   encoded audio/video data stream, the circuit switch 350

3   allocates an IMUX which aggregates the data streams into a

4   wideband data stream on the bus 226, preferably utilizing a

5   bonding protocol.

6   FIG. 4 depicts components of an exemplary processing

7   train 302. Processing train 302 includes a communication

8   process 404 and video and audio codecs 406 and 408. In the

9   receive mode, the combined data stream 344 is directed to

10   communication process 404 which carries out a predetermined

11   set of functions with respect to data stream 344.

12   According to one embodiment of the invention,

13   communication process 404 implements the multiplexing,

14   delay compensation and signaling functions set forth in ITU

15   Recommendation H.320 ("Narrow-Band Visual Telephone Systems

16   and Terminal Equipment"). In particular, communication

17   process 404 includes a multiplexer/demultiplexer for (in

18   the receive mode) extracting separate audio and video

19   signals from mixed data stream 344 in accordance with ITU

20   Recommendation H.221. Communication process 404 may

21   further include a delay compensation process for inducing a

22   delay in the audio data path in order to maintain lip

23   synchronization. A system control unit is incorporated

24   into communication process 404 and is configured to

16

1 establish a common mode of operation with remote conference

2 endpoint 102 in accordance with ITU Recommendation H.242.

3 Audio codec 408 receives the audio data stream from

4 communication process 404 and applies redundancy reduction

5 decoding in accordance with a standard (e.g., ITU

6 Recommendation G.711) or proprietary audio compression

7 algorithm. The decoded audio data stream is then sent to

8 audio mixing module 308, as described above. Similarly,

9 video codec 406 receives the video data stream and applies

10 redundancy reduction decoding in accordance with a standard

11 (e.g., ITU Recommendation H.261) or proprietary video

12 compression algorithm. The decoded video data stream is

13 subsequently sent to video switching/continuous presence

14 module 306 for combination with video data generated by

15 remote conference endpoint 104 and near conference endpoint

16 100, as described above in connection with FIG. 3.

17 In the transmit mode, video codec 406 encodes the

18 video data stream output by video switching/continuous

19 presence module 306 (representative, for example, of a

20 "continuous presence" image) using a standard or

21 proprietary video compression algorithm (e.g., H.261) and

22 delivers the encoded video data to communication process

23 404. Audio codec 408 encodes the audio data stream output

24 by audio mixing module 308 (representative, for example, of

1 the blended speech of conference participants located at

2 near conference endpoint 100 and remote conference

3 endpoints 102 and 104) using a standard or proprietary

4 audio compression algorithm (e.g., G.711) and delivers the

5 encoded audio data to communication process 404.

6 Communication process 404 multiplexes the encoded

7 audio and video data streams into a single audio/video data

8 stream 344 of relatively high bandwidth. The audio/video

9 data stream is conveyed to circuit switch 350, which breaks

10 up and distributes the high-bandwidth audio/video data

11 signal over plural ISDN channels as further described

12 hereinbelow.

13 It is noted that, while not depicted in the Figures,

14 processing train 302 may include a data codec for coding

15 and encoding still images and the like received from or

16 transmitted to remote conference endpoints 102 and 104.

17 With reference to FIG. 5 the network interface 224

18 includes a time division multiplexer 502 which receives the

19 wideband data stream 226 from the circuit switch 350. The

20 time division multiplexer 502 is coupled to a plurality of

21 ISDN ports 504 for receiving and transmitting signals on

22 lines 240, 242, 244, and 246.

23 The present invention advantageously utilizes

24 software-based processing of video and audio data streams

18

1 to implement a multi-point conferencing capability in a

2 conference endpoint. By dynamically generating a separate

3 instance of a processing train for each remote endpoint

4 session, a videoconferencing system embodying the invention

5 may easily and flexibly accommodate endpoint sessions

6 comprising a range of connection bandwidths and

7 communication protocols. Other advantages will occur to

8 those of ordinary skill upon review of the foregoing

9 description and the associated figures.

10   It is to be understood that the detailed description

11 set forth above is provided by way of example only.

12 Various details of design, implementation or mode of

13 operation may be modified without departing from the true

14 spirit and scope of the invention, which is not limited to

15 the preferred embodiments discussed in the description, but

16 instead is set forth in the following claims.

What is claimed is:

1   1.   A multi-point conferencing apparatus for conducting a

2   conference with a plurality of remote conference endpoints

3   linked for communication by a network, the apparatus

4   comprising:

5   a multi-point conference application for receiving

6   audio and video signals from the plurality of remote

7   conference endpoints, processing the received audio and

8   video signals, combining the processed audio and video

9   signals with the local audio and video signals, and

10   transmitting the combined audio and video signals to each

11   of the plurality of remote conference endpoints, the multi-

12   point conference application being configured to create a

13   plurality of processing trains corresponding to the

14   plurality of remote conference endpoints, each processing

15   train processing audio and video signals from a selected

16   one of the remote conference endpoints.

1   2.   The apparatus of claim 1, wherein the multi-point

2   conference application comprises a circuit switch for

3   instantiating the plurality of processing trains, the

4   circuit switch including dynamically allocable inverse

5   multiplexers.

1   3.   The apparatus of claim 1, wherein the multi-point

2   conference application includes a video switching module

3   for combining the remote and local video signals, and an

4   audio mixer for combining the remote and local audio

5   signals, the video switching module and audio mixer

6   directing the combined signals as input to each of the

7   processing trains.

1   4.   The apparatus of claim 3, wherein the video switching

2   module is selectively operable in a continuous presence

3   mode, wherein images corresponding to each of the plurality

4   of conference endpoints are displayed in separate areas of

5   a composite image.

1　5.　The apparatus of claim 1, further comprising a

2　plurality of ISDN ports, each coupleable to an ISDN line,

3　for receiving and transmitting audio and video signals from

4　and to the conference endpoints over the network, each

5　conference endpoint having at least one of the plurality of

6　ISDN ports corresponding thereto.

1　6.　The apparatus of claim 1, wherein each of the

2　plurality of processing trains comprises a communication

3　process and a set of codecs.

1　7.　The apparatus of claim 6, wherein the communication

2　process comprises an H.320 communication process.

1   8.   A method for conducting a conference between a near

2 conference endpoint and a plurality of remote conference

3 endpoints connected for communication by a network,

4 comprising the steps of:

5   at the near conference endpoint:

6   generating local audio and video signals;

7   receiving audio and video signals from the plurality

8 of remote conference endpoints;

9   creating a plurality of processing trains for

10 processing the received signals, each processing train

11 uniquely corresponding to one of the plurality of remote

12 conference endpoints;

13   processing the received audio and video signals;

14   combining the processed audio and video signals with

15 the local audio and video signals; and

16   transmitting the combined audio and video signals to

17 each of the plurality of remote conference endpoints.

18 9.   The method of claim 8, wherein the step of creating a

19 plurality of processing trains includes creating a

20 communication process and a set of codecs.

1   10. The method of claim 8, wherein the step of combining

2   the processed audio and video signals is performed using an

3   audio mixer and a video switching module.

4   11. The method of claim 8 further comprising providing a

5   circuit switch for instantiating the plurality of

6   processing trains, the circuit switch including dynamically

7   allocable inverse multiplexers.

8   12. The method of claim 10, wherein the video switching

9   module is selectively operable in a continuous presence

10   mode, wherein images corresponding to each of the plurality

11   of conference endpoints are displayed in separate areas of

12   a composite image.

1   ABSTRACT OF THE DISCLOSURE

2

3   A videoconferencing apparatus includes a multi-point

4   (MP) conference application that enables the apparatus to

5   combine and distribute audio and video signals received

6   from a plurality of remote conference endpoints, thereby

7   obviating the need to provide a separate multi-point

8   control unit (MCU) having hardware-based inverse

9   multiplexers (IMUXs). The videoconferencing apparatus has

10   a plurality of communication ports (typically ISDN ports)

11   for coupling the videoconferencing apparatus to the remote

12   endpoints through a switched network. The MP conference

13   application is configured to generate, for each remote

14   conference endpoint participating in a conference, discrete

15   instances of a signal processing train by means of

16   dynamically allocable IMUXs, each processing train

17   including a communication process (including

18   multiplexing/demultiplexing and signaling functions) and

19   audio/video/data codecs. Signals received at the

20   communication ports are directed to the appropriate signal

21   processing train for separate processing of each endpoint

22   session. The processed audio and video signals are

23   subsequently conveyed to an audio mixer and video switching

24   module for combination with locally-generated audio and

25

1 video signals. The outputs of the audio mixer and video

2 switching module are sent to each of the plurality of

3 signal processing trains, which process the combined

4 signals according to a transmit mode for distribution to

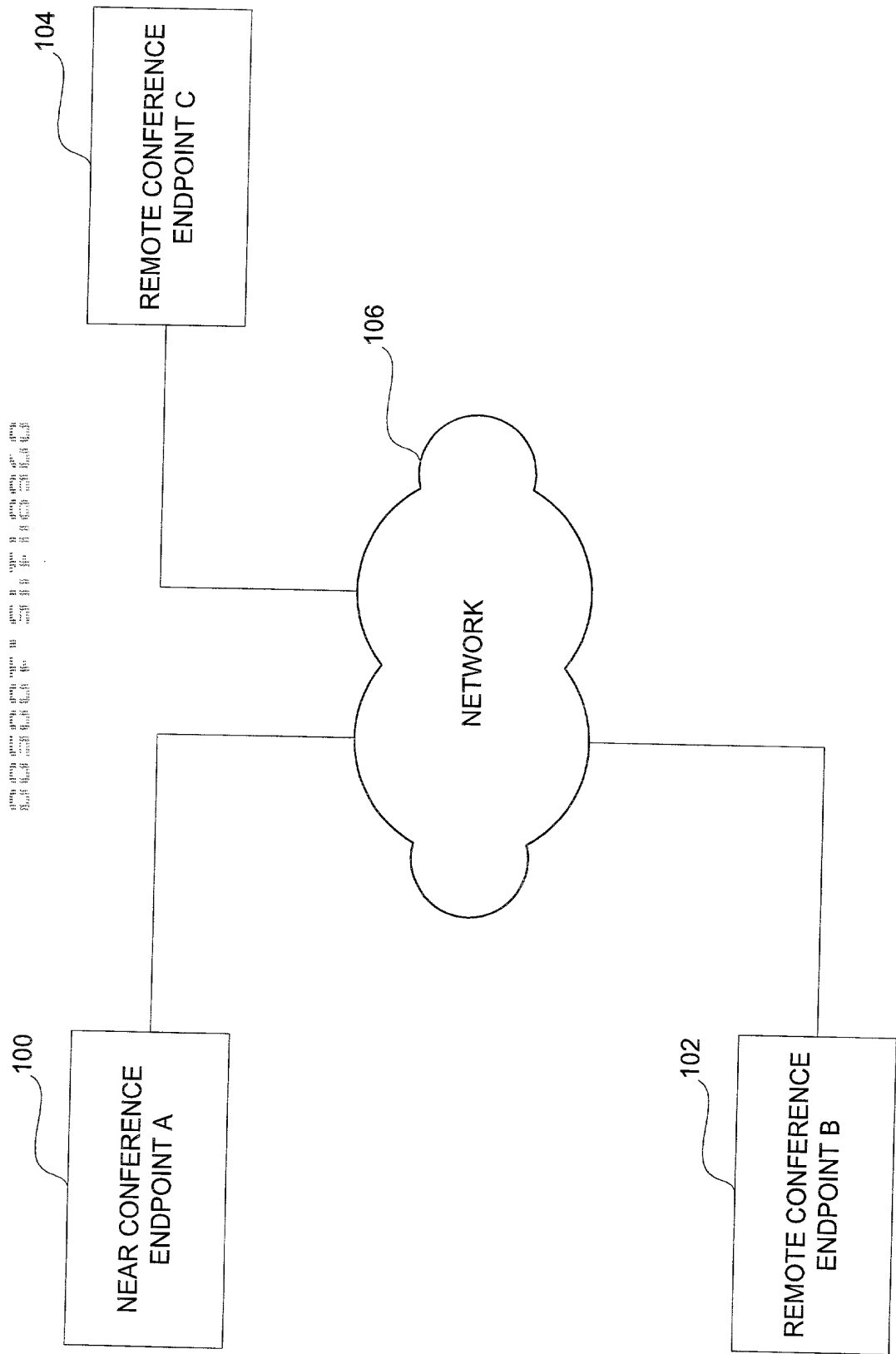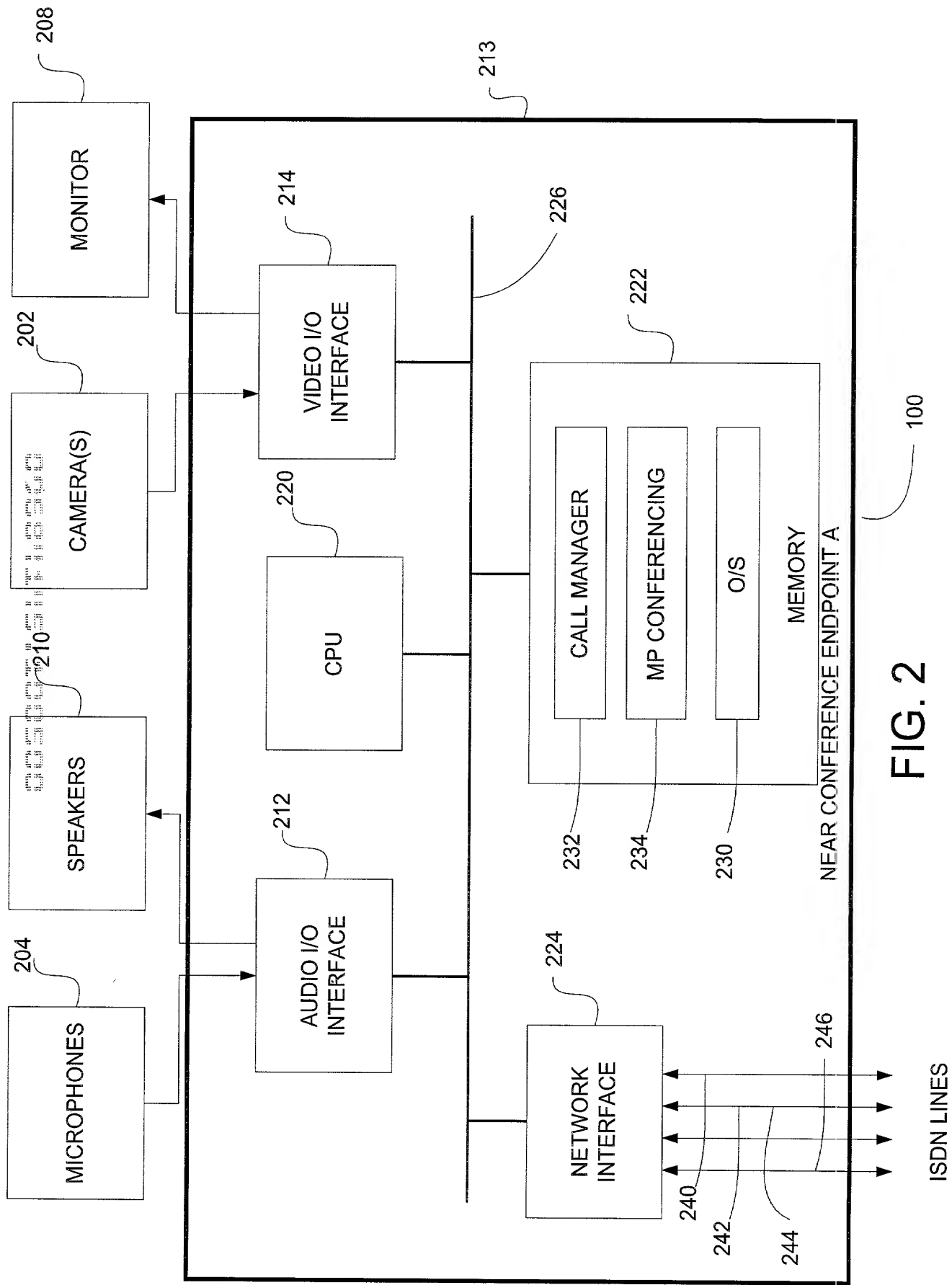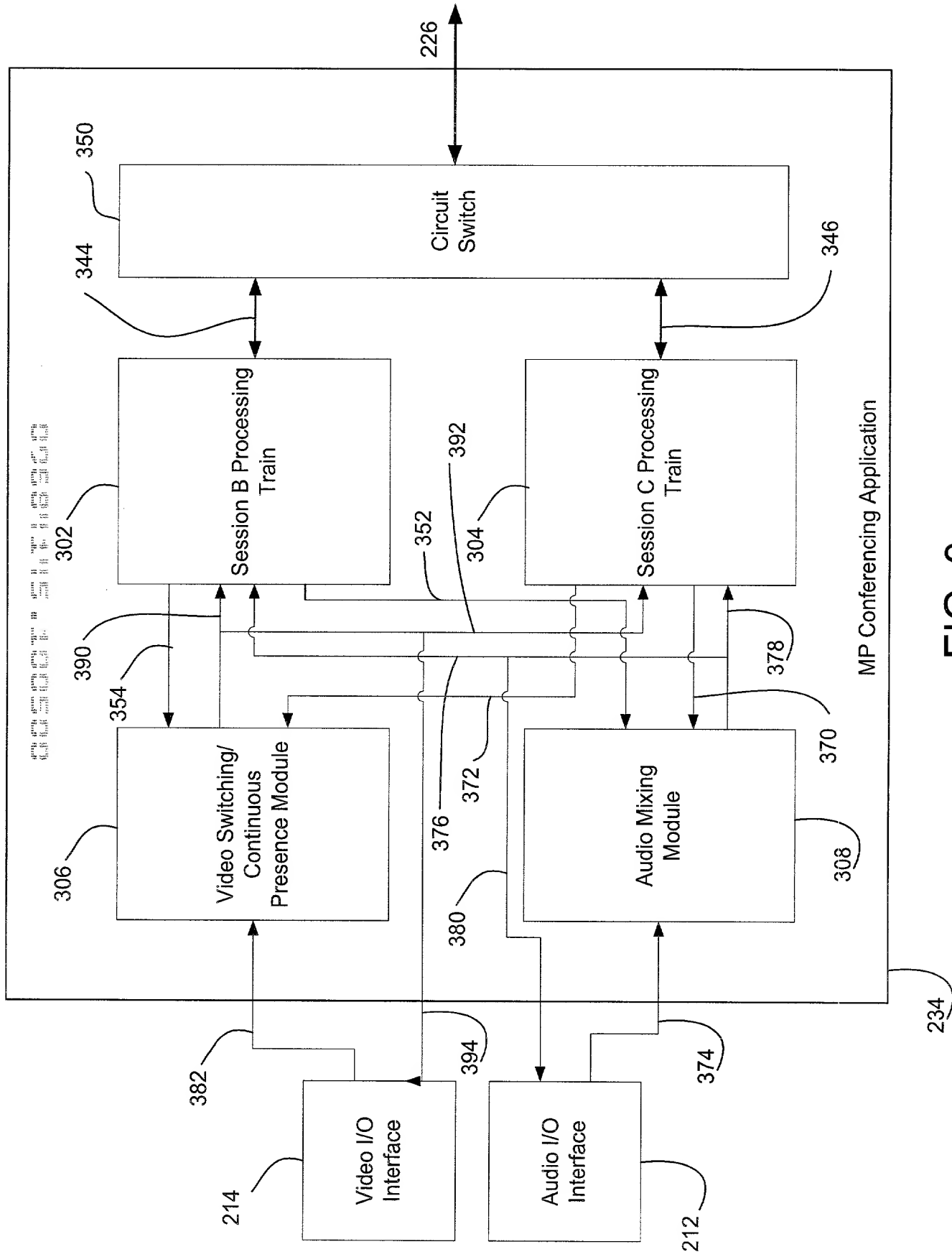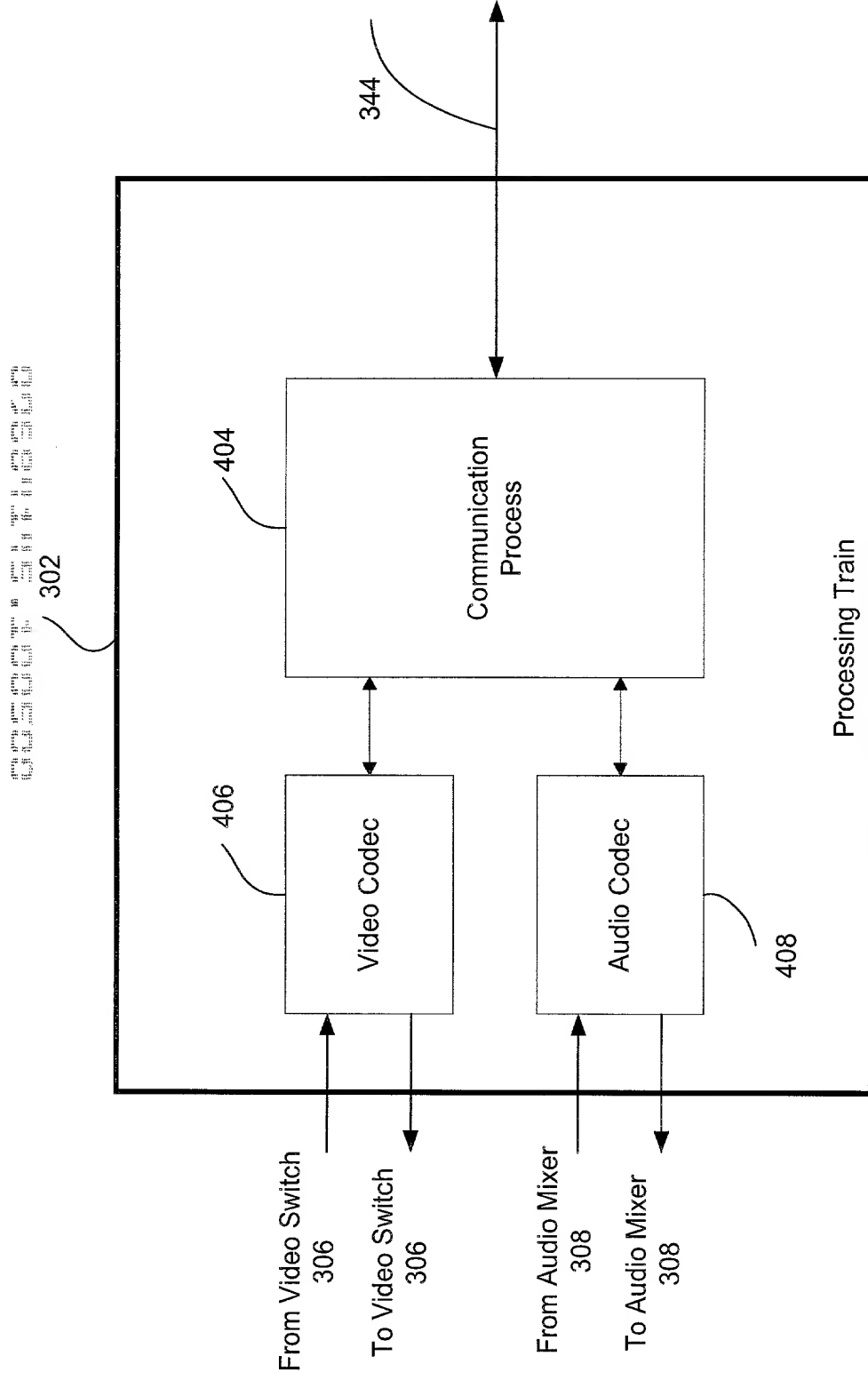5 the remote endpoints over the switched network.

NEAR CONFERENCE
ENDPOINT A

100

REMOTE CONFERENCE
ENDPOINT C

104

NETWORK

106

REMOTE CONFERENCE
ENDPOINT B

102

FIG. 1

FIG. 2

FIG. 3

FIG. 4

240

242

244

246

224

ISDN Port

ISDN Port

ISDN Port

ISDN Port

504

502

Time Division
Multiplexer

226

Network Interface

FIG. 5